

## CLAIMS

1. Method for determining preferred input operating points for a vehicle powertrain system including an engine and a transmission comprising:  
defining an output operating region of interest for the transmission;  
defining an input operating region of interest for the transmission;  
5 for points of operation within said output operating region of interest, determining preferred operating points within the input operating region as a function of preselected losses within the powertrain.
2. The method as claimed in claim 1 wherein said preselected losses are selected from the group consisting of engine losses and transmission losses and combinations thereof.
3. The method as claimed in claim 1 wherein said vehicle powertrain is a hybrid powertrain including an electric motor and battery, wherein said preselected losses are selected from the group consisting of engine losses, transmission losses, motor losses and battery losses and  
5 combinations thereof.
4. The method as claimed in claim 1 wherein said vehicle powertrain is a hybrid powertrain including an electric motor and battery, further comprising determining preferred operating points within the input operating region as a function of battery constraints.
5. The method as claimed in claim 4 wherein a first set of preferred operating points corresponding to unconstrained battery usage is determined and second set of preferred operating points corresponding to fully constrained battery usage is determined.
6. Method for determining preferred input operating points for a vehicle powertrain system including an engine and a transmission comprising:

- defining an output operating region of interest for the transmission;
  - defining an input operating region of interest for the transmission;
  - 5 mapping valid combinations of input operating points within said input operating region and output operating points within said output operating region to a measure of powertrain system losses at said valid combinations;
  - and,
  - for output operating points within said output operating region,
  - 10 selecting input operating points within said input operating region from mapped valid combinations corresponding to predetermined criteria.

7. The method as claimed in claim 6 wherein said vehicle powertrain is a hybrid powertrain including an electric motor and battery, wherein predetermined criteria are selected from the group consisting of powertrain losses and battery constraints and combinations thereof.

8. The method as claimed in claim 7 wherein said powertrain losses are selected from the group consisting of engine losses, transmission losses, motor losses and battery losses and combinations thereof.

9. The method as claimed in claim 7 wherein said battery constraints comprise no battery usage.

- 10. Method for determining preferred input operating points for a hybrid powertrain system including a hybrid transmission having an input coupled to an engine, an output, an electric motor and an electric battery comprising;
- 5 defining an operating space for the powertrain in transmission input speed ( $N_i$ ), transmission input torque ( $T_i$ ), transmission output speed ( $N_o$ ), and transmission output torque ( $T_o$ );
- determining aggregate powertrain system power losses throughout said operating space; and,

10                   determining at least one operating region in Ni, No, To  
corresponding to minimum aggregate system power losses wherein Ni within  
said determined operating region represents preferred input operating points.

11. The method as claimed in claim 10 wherein said transmission is  
a multi-mode transmission and said operating space is further defined in  
transmission modes.

12. The method as claimed in claim 10 wherein determining at  
least one operating region in Ni, No, To is performed for the entire operating  
space.

13. The method as claimed in claim 10 wherein determining at  
least one operating region in Ni, No, To is performed for a region within the  
operating space corresponding to system operation at zero battery power.

14. The method as claimed in claim 10 wherein determining at  
least one operating region in Ni, No, To is performed for the entire operating  
space and for a region within the operating space corresponding to system  
operation at zero battery power, wherein a pair of operating regions in Ni, No,  
5   To corresponding to unconstrained and fully constrained battery power is  
determined.

15. The method as claimed in claim 14 wherein said minimum  
aggregate system power losses are determined from a group of power losses  
consisting of engine losses, transmission losses, motor losses and battery  
losses and combinations thereof.